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Get In, Get Out, Stay Out

WORKSHOP ON PAVEMENT RENEWAL FOR URBAN FREEWAYS

(Six Years After)

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1. Introduction and Summary

It has been six years since the California Department of Transportation of (Caltrans), in coordination with the Federal Highway Administration (FHWA) and the Transportation Research Board (TRB) and, in conjunction with a select group of representatives of Transportation State Agencies, Nationwide Contractors and other public and local Agencies, dedicated an entire week to participate in the Workshop on Pavement Renewal for Urban Freeways, and take a serious look to a problem that for the last decade has become a primary concern, in highly urbanized areas throughout the United States: Crowded freeways with not enough time to repair them.

As a result of this week of discussions, brainstorming, presentation and exchange of new ideas, new or innovative technology, and focusing this effort in the proposal of solutions to a real project conditions, the concept of Get In, Get Out, Stay Out, was conceived and took form as a TRB Report Publication in the year 2000.

This publication compiled and outlined what this group envisioned and considered as the most innovative and “outside the box” engineering practices and technology, that once implemented, would provide a renewed roadway with a comfortable riding surface and minimal maintenance for the next 40 years, which obviously would translate into less interruptions to users, and therefore, more efficiency for the movements of goods and services.

In simple terms the problem that our freeway systems present is the growing number of obstacles and time constraints that transportation agencies have to face and overcome in trying to maintain the original freeway facilities in safe and acceptable operative conditions, under the pressure of a dynamic and demanding society that puts cars on the freeways at a rate that makes almost impossible to create the space and time to keep up with the normal “wear and tear” maintenance of our roadways.

Based on the outcome of the workshop, the California Department of Transportation has dedicated resources for the past years to the task of creating and implementing pavement renewal solutions that are in line with the Get In, Get Out, Stay Out concepts. This document presents a description of different tasks and experimental projects developed by California DOT in Southern California in pursue of achieving promising results that pave the way to future long lasting and minimal maintenance freeways.

2. The Challenge of Extending the Life of Pavement

During the Workshop the participants, divided in four teams, were presented with the challenge of providing solutions to reconstruct a segment of the Interstate 710 project with an approximate length of 16 miles. This route also known as the Long Beach Freeway, aside of being a key arterial route, serving one of the busiest ports in the world, and nine highly populated and industrialized communities, presented a combination of poor pavement conditions and high traffic volumes.

The basic objectives in creating the proposals of reconstruction were also specified: a) Provide a pavement with a service life of at least 40 years, b) Minimize traffic disruptions, c) Provide a safe environment for workers and highways users, d) Minimize short and long-term user costs, e) Minimize agency life-cycle costs and f) Minimize community and environmental impacts.

3. Workshop Findings and Recommendations

After a field visit to the segment of freeway under study, and the presentation of views and expectations of different speakers representing the community and public and private organizations, the teams developed their solutions, which were later reviewed, and their cost calculated by the California DOT engineering staff. Details of the solutions offered by the teams are provided in the above-mentioned Publication by the TRB, and they are out of the scope of this report.

The developed proposals cover an ample range of scopes and costs, and although they were different in these aspects, they all share features that addressed the basic objectives derived from the workshop slogan “Get In, Get Out, Stay Out”. The common denominator of the solutions and inherent features for their implementation were the provision of a low maintenance and long lasting pavement structure, the construction time and the minimal impacts to the community. Methodologies for how to handle traffic and reach the community, construction procedures, materials and equipment were suggested by every team in support of the different proposals.

The cost estimates of the different proposals were figured out by the California DOT engineering staff taking into consideration, among other factors, the pavement structure proposed, suggested traffic control and equipment and/or construction procedures, that according to the team, fit best with the implementation of the solution proposed.

The scope of the proposals varied from a full replacement of the existing PCC pavement and existing bridges, at a cost of \$191.5 Millions, to a rehabilitation of the same, through the use of recycling techniques combined with a polymer based hot mix asphalt overlay (HMA), at a cost of \$64.9 Millions.

The way the traffic would be controlled for each solution was carefully analyzed by each team taking into account the traffic volumes, its impact to the surrounding communities, the accessibility of the Contractor the work site and freedom to move his construction equipment within the work area, and the configuration of the freeways and arterial highways within and beyond the project limits. Suggested methods varied from simple progressive weeknight lane

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closures to complex weekend full freeway closures, featuring counter-flow operations and staged construction phases that maximized the use of the roadway platform when complemented with the use of movable barriers.

Another consensus point among the teams was the great importance that a well planned public awareness campaign plays in the successful execution of complex roadway projects, where the time available to produce large amounts of work is of the essence. A Task Group on Community Relations and Public Affairs was formed to establish guidelines on this subject that would serve as a base-document for the public campaign for the reconstruction of the I-710 Freeway. This group met several months after the conclusion of the Workshop, and provided a list of what the group considered the main areas around which an effective public campaign should be developed; these were summarized in: a) Message, b) Audience, c) Delivery of the message, d) Community Feedback and e) Measuring the results. Every one of these five areas was discussed in detail among the members of the group and recommendations were drawn for the specific case of the Long Beach Freeway.

4. Creating and Implementing Solutions, California DOT Experience

“GET IN, GET OUT, and STAY OUT”, which had been a focus in Southern California with its high and heavy traffic volumes in major cities, for more than a decade. The cry became the official mantra of the workshop where the participants came to explore the many possibilities behind the premise that heavily traveled highways in the densely populated urban landscape can be structurally repaired to last more than 40 more years with only minor ride restoration interventions. Six years later, how much has been learned and implemented?

Several case histories of Southern California projects show what can be achieved when the team is committed to making the idea of “Get in, Get out, and Stay Out” a reality. But first, some basic information is needed about what each phrase really means to the California DOT...

Get In

Finding a construction window in which any productive work can be done when the morning Traffic begins to peak at 5 AM and continues unabated in both directions until after 10 PM is the challenge. This often means a 7- hour construction window is the best that can be negotiated for most urban projects. Such a tight construction window means using specialized traffic handling practices, accelerated construction practices, very early strength materials, and all the “best” practices, will be required and in many cases pioneered.

Extended construction windows, such as “55-hour” weekend closures, can frequently require specialized traffic-handling “detours”. Many of these include upgrading shoulders, re-striping, moving several lanes of one direction of travel to the opposite direction of travel, also called “counter-flow measures”, “quick-change” concrete barriers, peak-directional flow corridors, where opposing directions of travel share the same lanes at different times of the day.

If geometry permits, work can be done on the outside first to increase capacity, then inside lanes can be “taken” and renewed, or long-term counter-flow measures can divert

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traffic on to parallel routes or the opposite direction, with minimal change in flow. This was first seriously considered and then used during repairs after the Northridge Earthquake in 1994, it allows long corridors to be repaired without traffic interruption, and can result in substantial construction savings by using normal performing materials.

All of these measures require an extraordinary public awareness program to educate Transportation supporters and users, such as the Politician, Management, the motorist, professional driver, and tourist in making informed choices.

Get Out

These include methods, which allow the construction team to move quickly! Time is of the essence. All aspects of the construction must be planned ahead of time – how to make the work zone safe for the worker and the driver, how to quickly close the lanes to traffic, remove damaged pavement, replace it with high performance materials that can gain strength in a few hours, and return the work zone back to traffic on-time for the early morning commuter.

Particularly useful are innovations such as “quick –change” concrete barriers, non-impact pavement removal techniques, “early-opening-to-traffic”, very-high early-strength cements, which include specialty admixtures, cements, pre-cast segments, rapid result “real-time” testing equipment and methods, and early-dry sawing techniques.

Traffic control incentives and disincentives, such as early completion bonuses and lane rentals work wonders to keep the opening on and ahead of schedule.

Stay Out

Some people in California have a dream! They dream of a day that the highway repairs happen over night, with very few members of the public being inconvenienced by the work. They have a dream of these repairs lasting twenty, thirty and even forty or more years, so their friends, co-workers and others will only encounter the repair once during a lifetime career! Some say, “what is the point of spending all this effort, money, and the public trust if the resulting “improvements” do not last a long time?” Some say, “If we repair this roadway to last a long time, just think how the “quality dividend” can be used when we run out of things to repair. New roadways, safer buildings, more schools and hospitals are all possible!” And these repairs, if there is a quality, long-term focus, can often use familiar materials. But how, given the financial burdens all Governments are facing? It is important to be focused and not settle for the sometimes misleading fact that the Specifications and testing of the materials must insure that the products being used are durable and ready to go into service at the appropriate time.

5. Case Histories

Since 1994, the California DOT has been looking into better ways and methods that allow and lead this organization to utilize state of the art technologies for the renewal of aged freeways in urban areas. The following is a list of Case Histories for both, Asphalt Concrete and PCC materials, where the application of this philosophy has been put into practice and has provided a valuable experience throughout the past years.

5.1 Interstate 710 Asphalt Concrete Projects

Background

The Long Beach Freeway (I-710) has become the arena for the proposal and/or implementation of projects with the label “Get In, Get Out, Stay Out” concepts attached to them. This is a major north-south 22-Mile Interstate route used for interregional and intra-regional commuting and shipping through an urbanized corridor that provide access to the Los Angeles Central Business District from Long Beach and Pasadena Central Business Districts. This facility also provides access to the Catalina Island ferries, the Port of Long Beach, the Port of Los Angeles, the Long Beach Municipal Airport, the Long Beach World Trade Center, truck terminals in the vicinity of Vernon, and Cal State University-Los Angeles near Route 10. Because of the major ports and terminal, this facility serves a large of volume of truck traffic. Route 710 also serves several recreational points of interest.

Land Use

Land use along the Route 710 corridor varies. Between the Long Beach Harbor and the City of Commerce, heavy industry predominates. Future plans for the Ports of Long Beach and Los Angeles envision expanding these facilities. According to port access studies, by the year 2010 the projections show these facilities handling 223 million metric tons of cargo. Extensive redevelopment is taking place surrounding the port area in anticipation of this expansion. North of the port's sphere of influence, the land use changes from industrial to commercial and residential uses. Growth forecasts indicate a substantial increase of commercial and residential infrastructure for the three areas referred to.

Existing Freeway Facility

This is a six to twelve lane freeway facility throughout its 22-mile length. The southern 4 miles feature 6-12' lanes with 8' inside and outside shoulders. The freeway widens to 8-12' lane facility for the next 15 miles with some locations of up to 12 lanes. For the northern 3 miles of the freeway the section goes back to 6-12'lane with 8' inside and outside shoulders and a 46'-median.

The construction of this route goes back to the year 1954, with follow up projects over the years to accommodate the traffic increasing demands in a safe and efficient manner. The structure of the pavement consists basically of three layers 0.67 foot each one of imported subbase material, granular base material, in some segments stabilized with Portland cement, and Portland cement concrete slabs as riding surface.

Deterioration of the existing PCC pavement has been evident over the last years especially the outer lanes (Lanes Nos. 3 and 4) due to the heavy axle loads they have been subjected to by a relative high percentage of truck traffic. Slab cracking, spalling, depressions and low quality ride are common along this route and predominant for certain segments

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For the past years improvements have been done especially along the southern portion to improve the traffic operations of the freeway and have been focused in the replacement of the original metal beam median barrier with a PCC concrete barrier and the and the replacement of PCC slab at spot locations through critical segments.

Operating Conditions

Average Daily Traffic Volumes (ADT) for Route 710 for the year 2000, ranged from 140,000 to 218,000 along the Route. The projections for a 20-year period range from 153,000 to 227,000 with percentage of trucks varying between 8 and 15 percent. Peak directional volumes vary between 10,600 and 18,800 vehicles per hour. Accident Data for this route show about 17 areas of high accident concentration, most of them traffic congestion related.

5.2 Experimental Pavement Rehabilitation Project (2.5 Mile)

The first project went out to construction early in the year 2001 and was completed late in 2003. This was an experimental 2.5 Mile project, with a construction cost of 21 Million dollars, in the southern portion of the route. The main challenge was to handle of the traffic in a 6-lane segment of freeway with ADTs over 145,000 vehicles, and with truck percentages close to 15%. The design called for median barrier replacement, shoulder widening and a 9" overlay of a Polymer Based Asphalt (PBA), specially designed to carry the projected traffic loads and last for 30-40 years with minimal maintenance. A second challenge for this project was the placement of over 110,000 Tons of asphalt concrete with the traffic interruptions possible.

This construction of project was staged in four phases, first the median area and concrete barrier were worked with the protection of temporary barriers on both sides of the median; during the second phase the temporary barriers were moved to the outside edge of traveled ways to allow the widening of shoulders and drainage work; during the third stage the crack/seal and asphalt overlay operation was accomplished in segments, one side of the freeway at a time, by putting both directions of traffic on the other side of the freeway through the use of predetermined openings in the median, and combining the operation with movable barrier as a divider, throughout 55-hour weekend closures. This operation was repeated during eight weekends to complete this main task of the project. The fourth phase included the placing of a final 1" wearing surface of asphalt concrete and the completion of incidental and minor work, during weeknight closures.

Among the factors that contributed to the successful and safe completion of this project are the following:

- a. Use of movable barriers in combination with median openings (Crossovers). This allowed the Contractor to put both directions of the traffic on one of the roadways, while the other roadway was being worked on.
- b. Use of extended weekend closures (55 continuous hours) that allowed the Contractor to increase his productivity significantly as a result of a direct access to the work site and more room to move his transportation or construction equipment.

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c. Use of monetary Incentives/Disincentive in the Contract Special Provisions to encourage the contractor to reduce the number of weekend closures dedicated to the massive asphalt concrete overlay operation. Ten 55-hour weekend closures were estimated for the core operation of “crack and seat” the existing PCC pavement and placing an 8” asphalt concrete overlay, plus the removal and replacement of the full structure of pavement at over-crossing locations, where the roadway profile had to be lowered to meet vertical clearance requirements. An incentive/disincentive for \$100,000 per every reduced or added weekend was included as part of the project special provisions. This operation was completed successfully in 8 weekends thanks to the extra effort and construction strategy that the Contractor put into practice.

d. Use of an effective and well-planned public awareness campaign, early and immediate before the “begin construction” date of the project. This campaign was a key factor in coordinating and getting the industry, businesses, communities and general public to reduce their trips during the weekend closures or to take the alternate routes clearly identified and publicized through different media.

e. Use of a carefully designed Traffic Management Plan (TMP) that assisted the design team in determining the way the traffic should be handled throughout the construction period of the project. Based on traffic pattern characteristics, like continuous 24-hour volumes, types of traffic, operating speeds and delays calculations, this plan determined the best closure times for this segment of freeway, the progressive closure of lanes during weekdays, the law enforcement and emergency assistance needs, and the required detours and alternate routes recommended to avoid traffic congestion. Early in the design phase of the project, a team formed by roadway engineers, traffic engineers, project managers, material suppliers, and the asphalt industry met regularly in work sessions to deal with a variety of issues focused on determining and identifying construction methods, traffic handling procedures, production of materials, etc. that helped expedite the Contract’s operations, as suggested by the slogan Get In, Get Out. The results obtained from the application of TMP were considered a complete success, since it made possible to keep the traffic moving safely on one side of the freeway while the other side was the scenario of intensive construction activities. This project won the 2003 Roadway Workzone Safety Awareness Award in the category “Innovations in Technology “ (Methodology – Large Projects), sponsored by American Road & Builders Association (ARTBA) and the National Safety Council.

5.3 Other I-710 Long Life Asphalt Concrete Projects

The good results and experience obtained in the experimental project previously described for the south portion of I-710, were the basis to gain support in favor of implementing the long life pavement renewal strategy in the northern portion of the route, covering a length 17 Miles. This section has been split in two separate projects as described in the following sections:

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Project 1 - Interstate I-710 Asphalt Concrete Project, I-405 to Firestone Boulevard

This is 9-mile project traverses through six communities and has roadway pavement characteristics very similar to the south portion, except for a small segment, at interchange location with other major freeway, where current geometric and pavement standards were incorporated. This project is currently under design at a cost estimated at \$110 Millions, and will basically feature the same design characteristics of the previous segment with minor adjustments.

It is expected that traffic will be handled through the crossover method in combination with a movable barrier system, which will allow to place both directions of traffic in one side of the roadway. Due to the size and complexity of this project, when compared to the experimental project, more ITS elements will be considered during the TMP planning in the pursue of keeping safe operating flows during the construction phase. The main construction operation for the Contractor will be the placing of more than 340,000 Tons of Asphalt Concrete over a period of 30-40 weekend closures. It is expected that this project will go out to construction late of 2005.

Project 2 - Interstate I-70 Asphalt Concrete Project, Firestone Boulevard to I-10

This second 7-mile project will close the gap between Firestone Boulevard and I-10. The project has similar design features to the previous described project, with the difference that this project will address the widening of 15 bridges along their entire combined length (16 Miles). The project cost estimate is \$220 Million and may go out to construction late in 2007. Again the construction strategy will be a challenge and it should be based on the experience accumulated from the 2 previous projects.

6. Experimental Projects with PCC Pavement

Since 1994, California has been using methods that have led to the current state of the art of Urban Pavement Renewal.

6.1 Non-impact Pavement Removal

When the Strategic Highway Research Program (SHRP), Special Pavement Studies (SPS), suggested a new way to remove concrete panels, and when the new method was used on several projects, California realized that the treated bases were often in excellent condition. This contradicted a long held assumption and belief that if the pavement was broken, so was the base.

The first formal use of the method on I-5 in Northern, California installed eye-bolts into each broken panel piece and lifted them out with a backhoe. The second formal use was on I-10 in Santa Monica which sawed the larger panel segments into bucket-sized pieces, which were lifted out by a backhoe. In both cases the treated base was in excellent condition. A demonstration of the production rate of the removal in Pomona, showed that 100 lane-feet could be removed in 20 minutes, for an hourly production rate of 300 lane-feet. At normal concrete production rates of 90 cy/hr, 300 lane-feet would take 3 hours to replace 8" of concrete pavement. Allowing the base

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to remain in place when in good condition reduces material costs and construction time by more than 30%.

The method was selected for an Excellence in Transportation Award in 1995, and is specified on all pavement rehabilitation projects in California.

6.2 Fast-Setting-Hydraulic-Cement-Concrete (FSHCC)

After the disappointment of 80 psi panel replacements, which failed as soon as they were loaded by 400 psi traffic, ways to achieve 400 psi pavement became a California priority.

The first attempts to specify this “new” type of concrete was called Fast-Setting-Hydraulic-Cement-Concrete (FSHCC), because it used cements that gained strength when mixed with water, and whose mineralogy was allowed to differ from Portland Cements. Durability requirements such as sulfate resistance, low shrinkage and high thermal stability were included to eliminate long term durability problems. Although written to allow Portland Cements with accelerating admixtures, qualifying specialty cements were frequently chosen by Contractors to perform the work. The special provision specified a strength gain window, such as three, four or eight hours before opening to traffic.

Initially used to speed-up soil-cement backfills on I-10 in Los Angeles, during the Northridge Earthquake repairs, the first use of FSHCC as a pavement was requested by a Contractor on I-110 in Los Angeles, as a Cost Reduction Incentive Proposal (CRIP). Additional work using FSHCC was included in many panel replacement projects. To allow delivery from the plant, many mixes used retarders before strength gain allow placement at the job site. To avoid time delays caused by retarders, some projects mixed all of the non-reactive materials, such as aggregate, water and fly ash, at the plant, and added the cement from a silo or super-bag at the job site. On one job on I-5 in Burbank, the opening strength of 400 psi was reached nightly in less than 2 hours. To demonstrate the capability of the special provision, 500 cy of Ready-Mix FSHCC was placed at night on I-605 in Santa Fe Springs with a single-lane slip-form paver. Another project on I-60 in Pomona, placed 4000 cy from an on-site batch plant, using end-dump trucks, in front of a two-lane wide slip-form paver, during 100+ degree summer temperatures.

These demonstrations culminated in 14 lane-miles of pavement rehabilitation on I-10 in Pomona, which drilled tie-bars, placed dowel bars, and utilized an extended weekend closure and 7-hour nightly closures, using quick-change concrete barriers. The project was awarded the 2001 ACPA Excellence in Concrete Pavement Award for Restoration and for Transportation Management, California 2001 Tranny Award for Transportation Management, Caltrans 2001 Partnering Award (Bronze), 2001 Marlin J. Knutson Award for Technical Achievement, and California 2002 Excellence in Transportation Award for Innovation.

6.3 Rapid Strength Concrete (RSC)

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The FSHCC Special Provision was revised to allow more editing options during design, and renamed to: Rapid Strength Concrete (RSC), which more accurately describes the intent of the special provision. The RSC special provision still requires 400 psi at opening to traffic. The biggest revision is time of opening is determined by traffic control charts for the project. The Contractor needs to select and test a mix that will have the required strength and meet the traffic control requirements. In a 7-hour closure, he would need a very fast mix, i.e. less than 4-hour strength gain. For longer closures, such as an extended weekend of 55 hours, he could select, for example, a 12-hour mix, and use a faster mix toward the end of the closure period.

One of the benefits to maintaining commitment to Early-Opening-to-Traffic Concrete Specifications, is that several companies have developed new accelerating and retarding admixtures that have added dimension to this already successful endeavor.

6.4 Pre-cast Concrete Panels

While everything to date has improved the state-of -the-practice of Urban Pavement Renewal, there still remains the issue of increasing traffic volumes, needed structural capacity improvement, and concerns about quality of work performed at night and all-weather construction issues.

A demonstration project is under way on I-10 in El Monte, to install pre-stressed, pre-cast, post-tensioned, Portland Cement Concrete pavement panels. The method is very promising since it incorporates pre-stressed steel, and post-tensioning which will make in-kind replacements more durable and longer lasting. In addition, night-time temperatures, quality and length of strength gain will become issues of the past, since all of the fabrication is done prior to assembly on the job site.

The method with out the post-tensioning can also be used to replace individual panels. It is expected that a stock-pile of panels, which can be cut to size and set on a bed of grout, will some day be available for emergency and routine panel replacements.

6.5 The Pay-off

We are seeing the benefits of these efforts already. This pioneering work has resulted in longer lasting durable PCC pavements and repairs. Although much has been achieved, much more needs to be done, and long-term commitment is necessary to keep the advances going.

One day, the career commuter will only encounter a significant project delay on any highway once in forty years.

One day, drivers will no longer drive by a construction site longingly looking at fresh concrete wishing and perhaps wondering why those lanes are closed, when no activity seems to be going on. Traffic control can re-open lanes as soon as the panels are in place.

One day, due to long lasting and durable highway repairs, money will be spent to build new facilities instead of continuously repair old ones.

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On that day, the money we spend now to GET IN, GET OUT and STAY OUT, will be well spent.

7. Conclusions

When we look back as an organization and try to assess the value of the exchange of experience lived during the Workshop on Pavement Renewal for Urban Freeways, where new ideas were shared and viewpoints and expectations from diverse sectors of freeway users were presented, there is no doubt that the workshop was an exercise that brought enrichment and a broader vision to our multidisciplinary transportation teams to find and create better solutions to a common concern of our modern society.

The application of the innovation and creative “thinking outside the box” concepts, learned during the workshop, have produced for the California DOT its first successful result, through the experimental project on the south portion of Interstate 710 Freeway. This achievement may be the spark to expand the application of the acquired experience to other freeways within California and hopefully to other U.S. DOTs Agencies in the near future.

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